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LUMINARY MEMO #244

To: Distribution
From: D. Eyles
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Subject: EMP For P47 Ascent

If a breakdown in communications makes it impossible to target P12, and it is urgently necessary to get off the moon, P47 may be used to monitor the ascent burn. The EMP given here enables displays of forward and lateral velocity, altitude, and altitude rate instead of the standard display of accumulated delta-V in noun 83. With this EMP in operation noun 83 contains meaningless data. Nouns 63, 64, and 94 contain good information (altitude-rate and altitude) in R2 and R3, but have garbage in R1. Noun 60 is the one to use, as follows:

V 16 N 60 E	R1: Forward velocity.
	R2: Altitude-rate.
	R3: Altitude.

Forward velocity is with respect to the moon, not inertial, but this only makes a difference of 14 f/s.

The EMP would be loaded into vac area 5 after landing but would remain dormant until activated by V 31 E just before the selection of P47. The EMP runs every 20 ms. It always sets MUNFLAG. Thus MUNFLAG is sure to be set between V37, which resets it, and PREREAD, which selects the ascent-descent average-G instead of the P40s one if it is set. As soon as AVEGFLAG is set, indicating that average-G is on, the EMP resets SURFFLAG. (This cannot be done before because it might foul up

the state vector integration.) Thus from the beginning mass is decremented, as though the engine were thrusting to match lunar gravity. Thus the engine should be lit as soon as possible after P47 is selected - although small mass errors are of little consequence. (It would be possible to alter the EMP to reset the SURFFLAG 30 seconds or any other specified time after P47 selection.) Finally, the start-up routine resets the R10FLAG to permit the computation of forward velocity.

The EMP, in two forms, follows:

EMP FOR ASCENT WITH P47

The EMP enables computation and display of forward and lateral velocity, altitude, and altitude-rate during P47. It resets SURFFLAG as soon as average-G starts. Noun 83 (the normal P47 noun) contains garbage. V 16 N 60 should be used instead, giving:

R1: Forward velocity
R2: Altitude-rate
R3: Altitude

Noun 26 load:

V 25 N 26 E 1 E 661 E 10100 E

Start-up procedure (should immediately precede V 37 E 47 E):

V 31 E

660	00000	reserves VAC5	710	44735	CS	SURFFBIT
661	34746	CA ZERO	711	70104	MASK	FLAGWRD8
662	54660	TS VAC5USE	712	54104	TS	FLAGWRD8
663	30703	CA 703	713	10752	CCS	PHASE1
664	54335	TS DNTMGOTO	714	03532	TC	DNPHASE2
665	44743	CS R10FLBIT	715	05355	TC	PHASCHNG
666	70074	MASK FLAGWRD0	716	07011	OCT	07011
667	54074	TS FLAGWRD0	717	77777	OCT	77777
670	05263	TC TASKOVER	720	00661	OCT	00661
671	34746	CA ZERO	721	10100	OCT	10100
672	54660	TS VAC5USE	722	03532	TC	DNPHASE2
673	40102	CS FLAGWRD6				
674	74735	MASK MUNFLBIT				
675	26102	ADS FLAGWRD6				
676	40103	CS FLAGWRD7				
677	74740	MASK AVEGFBIT				
700	10000	CCS A				
701	00713	TC 713				
702	00710	TC 710				
703	00671	starting address of EMP				

Loads for P47 ascent:

Load 1: V 71 E
 24 E
 660 E
 E
 34746 E
 54660 E
 30703 E
 54335 E
 44743 E
 70074 E
 54074 E
 5263 E
 34746 E
 54660 E
 40102 E
 74735 E
 26102 E
 40103 E
 74740 E
 10000 E
 713 E
 V 33 E

Load 2: V 71 E
 23 E
 702 E
 710 E
 671 E
 E
 E
 E
 E
 44735 E
 70104 E
 54104 E
 10752 E
 3532 E
 5355 E
 7011 E
 77777 E
 661 E
 10100 E
 3532 E
 V 33 E